1984 ANNUAL REPORT

The Coordinating Committee of Maritime Electrical Utilities

presented to
The Council of
Maritime Premiers

RAPPORT ANNUEL 1984

Comité coordonnateur des entreprises d'électricité des provinces maritimes

présenté au
Conseil des premiers ministres
des Maritimes

Maritime Electric Company, Limited

New Brunswick Power

Nova Scotia Power Corporation

Maritime Electric Company, Limited

Énergie N B

Nova Scotia Power Corporation

THE COORDINATING COMMITTEE OF MARITIME ELECTRIC UTILITIES

1984 ANNUAL REPORT

TO

THE COUNCIL OF MARITIME PREMIERS

02658

March 15, 1985

Premier J.M. Buchanan
Premier R.B. Hatfield
Premier J.M. Lee

Sirs:

It is with pleasure that we, the members of the Co-ordinating Committee of Maritime Electric Utilities, submit our Annual Report.

The Co-ordinating Committee of Maritime Electric Utilities (CCMEU), having now completed its fourth full year of operation, feels that its existence has helped to promote and ensure full co-operation among the region's electric power utilities.

We also believe that CCMEU serves a useful role in identifying, discussing, and quantifying the benefits of such co-ordination for the Council of Maritime Premiers.

Respectfully,

J.H. Reynolds
Chairman, CCMEU
Maritime Electric Company Limited

D.G. Brown
Secretary, CCMEU
Nova Scotia Power Corporation

G.L. Titus
Member, CCMEU
New Brunswick Power

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1.0 SUMMARY OF FINDINGS

1.1 General

The committee feels that the terms of reference provided by the Council continue to be satisfactory and will result in the ability to provide valuable information to both the Council and the Utilities in matters relating to the efficient regional development and operation of the Maritime Electric Power Systems.

The individual Operating, Planning, and Research and Development Subcommittee reports provide an overall appreciation of Committee results.

Highlights from these subcommittee reports reveal the following:

1.2 Regional Operating Subcommittee Report

The interconnected operation of the member utilities again achieved increased reliability of service and lower costs to customers. The exchange of 1.2 billion kW.h of electrical energy between member utilities in 1984 resulted in a near-record saving of 25 million dollars. This figure does not include the benefits resulting from the joint ownership of Dalhousie Unit No. 2 by N.B. Power and Maritime Electric (PEI) Limited.

The ongoing coordination of transmission system maintenance and of generation maintenance scheduling plans continues to ensure improved reliability and enables the utilities to realize economies.

1.3 Regional Planning Subcommittee Report

The report summarizes the regional load forecast, load-resources review and generation expansion analysis carried out over the past year for the Maritime Utilities.

The load forecast is based on the forecasts of the individual utilities. Average annual growth rates over the years 1984/85 and 1999/2000 are expected to be 2.9% for energy and 3.0% for peak demand. Over the past two years, industrial sales have recovered to slightly above the 1981/82 levels; and total sales have grown an average of 3.5% per year.

From a reliability viewpoint, the load-resources review indicates an adequate level of generation reserves in the Maritime Provinces until near the end of the century. Work is continuing on the development of generation expansion alternatives. More work is required before firm conclusions can be drawn.

1.4 Regional Research and Development Subcommittee Report

The subcommittee is pleased to report a continuing increase and improvement in co-operative activity in which the benefits of Research and Development in the Maritime Electric Utilities are being shared among member utilities.

A review of current R & D activity reveals the following projects in each utility:

1.4.1 New Brunswick Power

- Sulphur oxides removal from stack gas
- Conversion of an existing unit to fluidized bed combustion
- Determination of the energy required to produce domestic hot water
- Grand Lake generating station aquaculture project
- Utilization of thermal station cooling water for hatchery aquaculture
- Development of a residential energy audit procedure
- Large flow measurements for dye dispersion techniques
- Condenser fouling monitor
- Chatham coal-water mixture demonstration
- Waste heat utilization - surface heated greenhouse
- Fish culture facility utilizing waste heat from the Mactaquac generating station
- Circulating fluidized bed demonstration project
- Distributed mixing coal burner development

1.4.2 Nova Scotia Power Corporation

- Accelerated material evaluation of polymer insulators for transmission lines
- Annapolis Tidal Project
- Atmospheric fluidized bed studies
- Circulating fluidized bed feasibility study
- Coal-liquid mixtures
- Control of distribution line galloping
- Development of a one-ton line service truck body
- Feasibility evaluation of large-scale heat pumps
- Field testing of distribution equipment and line materials in a marine atmosphere
- Marginal cost based peak load pricing and load control study
- Osprey nesting on transmission lines
- Performance of preservative-treated white and red spruce poles - examination for checking toughness
- Wind generation experiment

1.4.3 Maritime Electric Company, Limited (Prince Edward Island)

- Wind test site - North Cape PEI
- Coal-liquid mixture combustion - Charlottown PEI
- Wood burning - Charlottetown plant

2.0 THE COMMITTEE

The membership of the Committee shall consist of one representative, and an alternate, from each of the electric utilities. Observers delegated by each Provincial Government and the Federal Government may attend Committee meetings.

2.1 Committee Membership

Mr. J. H. Reynolds, Chairman
President and C.E.O.
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Mr. D.G. Brown, Secretary
Vice President - Planning
Nova Scotia Power Corporation
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Mr. G. L. Titus, Member
Assistant General Manager,
Planning & Development
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2.2 Observers To The Committee

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Secretary To The Executive Council
Deputy Minister of Manpower
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Dept. of Energy & Forestry
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Barry Toole
Secretary, Cabinet Committee on Policy and Priorities
Cabinet Secretariat
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E. Martin Warnes
Advisor, Engineering & Research
Electrical Energy,
Energy Sector
Energy, Mines and Resources
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2.0 The Committee (cont'd)

2.3 Alternate Committee Members

F.C. MacLoon (Alt. Member)
Assistant General Manager, Engineering & Operations
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E3B 4X1

P. H. Newcombe (Alt. Member)
General Manager
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P.O. Box 1328
Charlottetown, P.E.I.
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L.J. Sweett (Alt. Member)
Vice President - Customer Services
Nova Scotia Power Corporation
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Halifax, Nova Scotia
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2.4 Committee Terms of Reference

The responsibility, structure, and operation of the Committee is intended to ensure a continuing high degree of cooperative effort among the electric utilities of New Brunswick, Nova Scotia, and Prince Edward Island in the development and operation of an economic and efficient interconnected regional electric power system.

Responsibilities of the Committee shall include:

(1) Development of coordinated load growth forecasts on an annual basis.
(2) Identification and evaluation of regional electric utility development opportunities.
(3) Development of optimum coordinated short and long range utility expansion plans.
(4) Coordination of operations of the three utility systems with the objective of minimizing total regional generation costs, and improving security of supply.
(5) Coordination of electric energy research and development, conservation and related activities of a regional nature.
(6) Provision of a regional focus for operations coordination with neighbouring utility systems.
(7) Such matters as may be referred to the committee by the Council.

The Committee shall meet at least quarterly with locations normally rotating among the three provinces.

The Committee shall submit a written report at least annually to the Council of Maritime Premiers.

2.0 The Committee (cont'd)

2.5 Subcommittee Membership

2.5.1 Regional Operating Subcommittee

Chairman: W.V. Wallace
Nova Scotia Power Corporation

Members: P. H. Newcombe
Maritime Electric Company, Limited

W.A. Patterson
New Brunswick Power

2.5.2 Regional Planning Subcommittee

Chairman: R. W. Brown
Nova Scotia Power Corporation

Members: J. L. Boomhower
Maritime Electric Company, Limited

D. G. Hayward
New Brunswick Power

2.5.3 Regional Research and Development Subcommittee

Chairman: J. A. Lea
Maritime Electric Company, Limited

Members: J. Kiuru
Nova Scotia Power Corporation

P. J. Whalen
New Brunswick Power

1984

ANNUAL REPORT

OF THE

REGIONAL OPERATING SUBCOMMITTEE

OF THE

COORDINATING COMMITTEE OF MARITIME ELECTRIC UTILITIES

Members:

W. V. Wallace - Chairman, NSPC
P. H. Newcombe MECL
W. A. Patterson NB Power

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3.1 EXECUTIVE SUMMARY

This is the fourth annual report of the Regional Operating Subcommittee to the Coordinating Committee of Maritime Electric Utilities and describes the Subcommittee's activities during 1984.

The interconnected operation of the member utilities again resulted in greater reliability of service to customers and lower costs to customers. The exchange of 1.2 billion kwh of electrical energy between member utilities in 1984 resulted in a near record saving of 25 million dollars. This figure does not include the benefits resulting from the joint ownership of Dalhousie Unit No. 2 by N.B. Power and Maritime Electric (P.E.I.).

Activities were ongoing in the coordination of generation maintenance scheduling plans and transmission system maintenance to ensure the continued realization of the economies of operation and improved reliability which this provides.

The Subcommittee continued its endeavours in relation to the determination of the best overall utilization of existing electrical energy resources.

3.2 RECOMMENDATIONS

It is recommended that the Regional Operating Subcommittee continue with the proposed activities for 1985 as described in Section 3.6.

3.3 TERMS OF REFERENCE

The Regional Operating Subcommittee shall consist of at least one member from each of the utilities in the Maritime region. The Subcommittee will meet at least twice yearly and will report to the Coordinating Committee of the Maritime Electric Utilities (CCMEU) at least twice yearly.

The Regional Operating Subcommittee shall undertake to do the following:

3.3.1 Monitor and report on activities within each utility with respect to changes in control and operating policy and practice.

3.3.2 Review, at least annually, the operating policies and practices in effect in the different utilities and determine if there are benefits of intergrating different operational aspects of the utilities.

3.3.3 Endeavour to determine the optimum dispatch of existing electrical energy resources on a regional basis including imports from outside the region and where beneficial, exports and report on any actions that the Subcommittee thinks could be beneficial to the utilities individually or collectively.

3.3.4 Attempt to identify and report on possible savings due to allocation of hydro on a regional basis and possible methods of sharing benefits from such allocation.

3.3.5 Submit minutes of Subcommittee meetings to the Secretary of CCMEU for distribution to CCMEU members and other Subcommittee members.

3.3.6 Submit a proposed work program and an expected budget requirement to the CCMEU by June 1 of each year.

3.4 ACHIEVEMENTS FOR 1984

3.4.1 Benefits from Interconnected Operation

The interconnected operation of the three member utilities results in an improved reliability of service to customers by reducing the frequency and duration of power interruptions. This is achieved primarily by the sharing of generation reserves required to protect against the tripping of a generator or a sudden increase in load in a member utility.

Interconnected operation results in lower costs to customers as well. The most obvious and readily quantifiable benefit in this regard is that associated with the exchange of energy on an hourly and weekly basis by the member utilities.

These benefits increased dramatically in 1983 to 27 million dollars. The 1984 volume was close to the 1983 level as were benefits which totalled 25 million dollars in 1984 as shown in the table below. This was a result of the continued high level of performance of N.B. Power's Point Lepreau Nuclear Unit and the Lingan Generating Station in Nova Scotia where the third and fourth 150 MW coal-fired units entered commercial operation in December, 1983 and June, 1984.

INTERCONNECTION TRANSACTIONS *

for period January 1, 1984 to December 31, 1984

Energy Transactions Between	Volume of Interchange (MWh)	Total Value of Transactions ($)	Benefits of Transactions ($)
N.B. Power to N.S. Power Corp.	417,843	8,962,000	3,297,000
N.S. Power Corp. to N.B. Power	397,933	13,588,000	5,971,000
N.B. Power to Maritime Electric Co.	412,844	24,325,000	15,910,000
	1,228,620	46,875,000	25,178,000

*Benefits for firm contract exchanges not included.

The addition of the DC tie between New Brunswick and Hydro Quebec in mid 1985 will contribute to the continuation of a high level of energy exchange in 1985.

3.4.2 Generation Maintenance Scheduling

Generation maintenance scheduling plans were exchanged by the members and reviewed to allow production costs to be reduced and to ensure that adequate generation reserves are maintained.

3.4.3 Transmission System Maintenance

An annual meeting of personnel responsible for maintenance in the three member utilities and Saint John Civic Hydro is held to further cooperation in this area. Data on spare parts and special tools and test equipment is updated and exchanged on an annual basis.

On March 20, 1984 extreme icing conditions caused the collapse eighteen steel towers on an 8 kM section of the 345 kV transmission line linking Nova Scotia and New Brunswick. The failure occurred in the Wentworth-Folly Lake area of Nova Scotia. Many of the towers and the sixteen 3,000 m. reels of conductor required to rebuild the damaged section were provided from NBEPC construction inventory. The assistance provided accelerated rebuilding of the line section, which was conpleted on May 4, and the continuation of the benefits to economic and reliable operation which are provided by the tie.

The coordination of requirements for spare towers and conductor is being undertaken by maintenance personnel.

Coordination was provided by the Subcommittee for transmission line outages affecting the three utilities which were associated with the construction of new 138 kV transmission facilities in Northern Nova Scotia.

3.4.4 Dispatch Facilities

Plans for energy control facilities have been revised considerably during the past year.

N.B. Power's plans for developing a new Control Centre have been deferred. It is now the intention to update and augment controls in existing facilities as practical and essential to cope with system expansion. A dual computer SCADA (Supervisory control and data acquisition) system was installed in the fall of 1984 to provide control of the expanded transmission facilities linking New Brunswick and Hydro Quebec. An interchange transaction analysis program (ITAP) was placed in service during the year for the purpose of increasing the benefits from energy interchange.

Installation of a SCADA system by Maritime Electric Co. is scheduled for completion in 1987 and will provide control of eight transmission and generation facilities. It will be coupled with an upgrading of the present operational communications system.

NSPC plans to extend the life of its present Control Centre through the replacement of the SCADA equipment at the Centre in 1987.

Close liaison by the Subcommittee will ensure that modifications to control facilities are compatible with the objective of determining the optimum dispatch of electrical energy resources on a regional basis.

3.4.5 Optimum Dispatch of Electrical Energy Resources

Optimum dispatch on a regional basis requires accurate and consistent information on the cost factors used in the dispatch.

In 1984 a Working Group with representatives from the three utilities was created to review and produce, to the extent possible, guides and standards for the following as they relate to the establishment of costs used in the interchange of energy:

1) test procedures to determine heat rates
2) start-up costs of units
3) maintenance and operating costs
4) provision for contingency costs
5) pricing formula

An operating reserve agreement which provides specific guidelines for the sharing of generation reserves on a short term basis between Nova Scotia and New Brunswick was completed. There were new applications of operating reserve transactions during the year involving the sale/purchase of non-synchronized reserve.

3.4.6 System Operation

Specific material for the training of system operators in the three utilities was reviewed during the year and determined to be unsuitable. Efforts are continuing towards the provision of joint training for system operators.

An evaluation was made of lightning storm locating systems which could be used to monitor the tie lines connecting the three utilities. Completion of a related Canadian Electrical Association research and development project will be awaited before a recommendation on the use of the systems is made.

3.6 Proposed Activities for 1985

3.6.1 Continue to evaluate and report on the annual benefits from interconnected operation.

3.6.2 Continue to exchange maintenance schedules of generation and major transmission facilities to enhance operating efficiency.

3.6.3 Update information exchanged on spare parts and apparatus for transmission facilities and specialized test equipment.

3.6.4 Continue efforts towards the provision of joint training for system operators.

3.6.5 Establish a schedule for the activities of the Working Group on production costs.

3.6.6 Establish a schedule for the further sharing of tie line regulation.

3.6.7 Identify the steps required to determine the benefits and the distribution of benefits associated with the joint dispatch of hydro.

ANNUAL REPORT

OF THE

PLANNING SUBCOMMITTEE

OF THE

COORDINATING COMMITTEE OF MARITIME ELECTRIC UTILITIES

JANUARY 1985

Members:

R.W. Brown - Chairman, NSPC

J.L. Boomhower MECL

D.G. Hayward NB POWER

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4.1 SUMMARY

This is the fourth annual report of the Planning Subcommittee to the Coordinating Committee of the Maritime Electric Utilities. The report summarizes the regional Load Forecast, Load Resource Review and Generation Expansion Analysis carried out by the subcommittee in 1984.

The Load Forecast is based on the forecast of the individual utilities. The past year has seen a substantial increase in domestic and industrial sales. Industrial sales have now recovered to slightly above 1981/82 levels. Total sales have grown an average of 3.5% per year over the past two years. Average annual growth rates over the years 1984/85 to 1999/2000 are expected to be 2.9% for energy and 3.0% for peak demand.

The Load-Resources Review indicates that, from a generation reliability viewpoint, there is an adequate level of generation reserves in the Maritime Provinces until the mid 1990's. The results are given in Tables 9, 10 and Figures 1 and 2.

Work is continuing on the development of generation expansion alternatives for the region. While some general trends are beginning to emerge, more analysis is required before detailed conclusions can be made relative to the proper timing and mix of generating sources required to meet the growing electrical needs of the three Maritime Power Systems on a combined basis.

4.2 RECOMMENDATIONS

It is recommended that the Planning Subcommittee continue with the proposed activities for 1985 as outlined in section 4.6 of this report.

4.3 TERMS OF REFERENCE

The Regional Planning Subcommittee shall consist of at least one member from each of the utilities in the Maritime Region. The Subcommittee will meet at least twice yearly and will report to the Coordinating Committee of Maritime Electric Utilities (CCMEU) at least twice yearly.

The Regional Planning Subcommittee shall, through whatever mechanism it deems necessary, Task Force appointment, consultant acquisition, etc., (subject to approval of CCMEU) undertake to do the following:

1. Prepare a load forecast showing the power and energy requirements of the region for approximately two decades. This load forecast shall be reviewed and updated, if necessary, annually.
2. Obtain the plans of the individual utilities and combine them to prepare a regional load-resource balance.
3. Identify possible benefits through short term deferral and/or advancement of provincially scheduled units and will so notify the CCMEU.
4. (a) Considering all feasible regional alternatives, prepare an optimum long term generation expansion plan (including major transmission when necessary) without regard to individual utility boundaries and without regard to proposed provincial units which have not been committed to construction. The development of any optimum expansion plan will always start with the then existing and committed facilities of the three Systems.

4.3 TERMS OF REFERENCE (Cont'd)

(b) Prepare a report comparing the optimum regional expansion plan with the sum of the individual expansion plans and report its findings to the CCMEU.

5. Periodically assess the potential for imports from outside the region or exports outside the region, the constraints imposed by existing transmission system limitations and will recommend the need or otherwise for studies of incrementing transmission capacity.

6. Submit a proposed work program and an expected budget requirement to the CCMEU by June 1 of each year.

4.4 WORK PROGRAM FOR 1984

The following is the 1984 work program as proposed in last year's Annual Report:

1. Continue development work on a regional generation expansion plan:

   a) Examine and where appropriate choose analytical techniques and programs to analyze:
      - Major transmission transfer capability and losses
      - Level of reliability
      - The present method of dispatching NB/PEI and NS
      - The potential improvements of integrated dispatch

   b) Review all major assumptions used and revise where necessary.

2. Produce the regional load forecast.

3. Produce the load resource balance for generation existing and under construction.

4. Write a formal report(s) on the subcommittee annual activities.

Initial expansion planning will consider the economic and financial implications of conventional coal and nuclear additions until a preliminary base plan is developed. The resulting plan will then be compared to alternatives such as pumped storage, conversions, hydro additions and variations in the tie capabilities external to the region.

4.4 WORK PROGRAM FOR 1984 (Cont'd)

While any specific expansion plan may demonstrate an economic preference over some alternate plan, such plan may be financially impractical to an individual utility or even an integrated utility concept.

It is important to note that the development of expansion plans on a regional basis is a complex and time consuming exercise. It is unlikely that much progress will be made beyond the examination of conventional coal and nuclear alternatives over the coming year.

4.5 ACHIEVEMENTS FOR 1984

4.5.1 Maritime Utilities Load Forecast

The individual Maritime utilities forecasts have been combined in Table 1 to give the regional load forecast. Average annual compound growth rates for the period 1984/85 to 1999/2000 are 2.9% for energy and 3.0% for peak demand. The overall growth is slightly higher than last year, 1999/2000 presently forecast as 4827 MW/26579 GWh as opposed to 4662 MW/26252 GWh.

Since the individual utility annual peak loads do not necessarily all occur at the same hour of the year, their arithmetic sum is usually greater than the annual peak load demand of the integrated regional system. A five year history of the hourly loads of each of the three utilities has been analyzed to determine the expected relationship between the forecast regional coincident peak load and the arithmetic sum of the individual utility peak loads. The results are shown in Table 2.

Table 3 summarizes the expected long term growth in energy sales by sector. Growth in the domestic sector has been fairly strong over the past two years. The commercial sector has seen only moderate growth. The industrial sector grew nearly 18% in the past year, recovering to slightly above the 1981-82 level. Overall sales increased 10.5% in 1983-84 and averaged 3.5% per year between 1981-82 and 1983-84. Between 1983/84 and 1999/2000 the forecast annual compound growth rate in total sales is 3.1%.

4.5 ACHIEVEMENTS FOR 1984

4.5.1 Maritime Utilities Load Forecast (Cont'd)

Tables 4 and 5 show respectively the regional monthly coincident peak demand and energy forecasts.

With all the uncertainties in the future variables which could effect the growth in electricity consumption, the forecast must be frequently updated, and can only act as a guide to utility planning.

4.5.2 Regional Load and Resources Review

The Load and Resource Review is intended to examine the ability of the regional utilities generating facilities to reliably meet the anticipated future demands of the customers.

4.5.2.1 Load Requirements

To allow for maintenance and account for forced or unexpected outages of generating units, the total generating capacity installed in the region must be greater than the regional load. This excess of generation over expected load is known as reserve. The load requirement to be met in the region consists of the forecast load in Table 1 plus a specified amount of reserve.

4.5.2.2 Resources

The generation resources are comprised of the total generation capabilities from both existing generating

4.5.2.2 Resources (Cont'd)

stations and those under construction. Retirement of older plant through time is also taken into consideration. Listings of the resources are given by Province in Tables 6, 7 and 8. The resources consist of a mix of hydro, coal fired thermal, oil fired thermal, gas turbine and nuclear generation.

4.5.2.3 Reserve Criteria

The present New Brunswick policy is to use two reserve criteria in the assessment of the ability of the generation to reliably serve the load. For the purpose of this regional examination, these criteria have been applied to the combined NB, NS and PEI systems.

4.5.2.3.1 Reserve Criterion for Peak Electrical Capability

The power reserve criterion for Peak Electrical capability requires that the total generating capacity available in each month be able to supply the load during the peak hour of the month with a surplus equal to 20% of the forecast firm load or the capacity of the largest unit, whichever is larger. To meet this criterion thermal and hydro generating units are considered available at their full rated capabilities.

4.5.2.3.2 Reserve Criterion for Sustained Electrical Capabilities

The reserve criterion for sustained electrical capability requires that the NB, NS and PEI systems jointly be able to withstand the continuous loss of the largest unit in the interconnected area. Because of the 230 MW of participation sales from the Point Lepreau nuclear unit, a unit loading of 405 MW will be relied upon within the New Brunswick system from that unit.

4.5.2.4 Solution Procedure

A comparison is made between the generation resources and the load required for each month of the study period. A surplus or deficit in the capability to supply is determined on both the reserve for the peak electrical capability and the reserve for the sustained electrical capability.

4.5.2.4.1 Peak Electrical Capability Assessment

The required reserve for peak capability is added to the peak forecast load to determine the total peak load that would have to be met. This total load is compared with the sum of the generation supplies available from hydro, nuclear and fossil units to determine

4.5.2.4.1 Peak Electrical Capability Assessment (Cont'd)

the surplus or deficit. In doing this calculation all generating units are considered to be available at their full net rated capability as given in Tables 6, 7 and 8. The results of this assessment are presented in Table 9, and Figure 1.

4.5.2.4.2 Sustained Electrical Capability Assessment

Assessment of the sustained electrical capability of the system examines the ability of the generation to meet, during every hour of each month, the forecast load plus the required sustained reserve. For this assessment nuclear and fossil units are assumed available at full rated capacity 100% of the time.

Low water conditions are utilized in determining the hydro contribution to sustained electrical capability.

The available storage water is regulated in a manner to maximize the benefits on the system. The results of the sustained electrical capability assessment are given in Table 10 and Figure 2.

4.5.2.4.2 Sustained Electrical Capability Assessment (Cont'd)

The load resource balance of the NB, NS and PEI systems has been carried out for each month of the year. This report provides only details of the minimum surplus month in each year, since this condition has been used to define the system surpluses and deficiencies and hence indicates from a reliability viewpoint when new generation is required.

For the purposes of determination of both the peak and sustained reserve capabilities the largest unit in the region is as follows:

1. Until 1991/92 - Point Lepreau at 405 MW
2. After 1991/92 - Point Lepreau at 635 MW

4.5 ACHIEVEMENTS FOR 1984

4.5.3 Regional Generation Alternatives

Using agreed upon criteria and assumptions, many generation expansion alternatives were examined. Work has focused on developing the following three options:

Utility plan - The sum of the individual utility plans.
Coal Plan - A regional coal generation expansion plan.
Nuclear Plan - A regional nuclear generation expansion plan.

Considerable effort was devoted to the examination of integrated versus individual utility operation of the region. The manner in which the region is presently operated captures the majority of the savings associated with integrated operation, but it is hoped some additional savings may be possible. Substantially more work is required before any conclusions can be drawn.

Over the past few months all planning criteria and assumptions have been reviewed and modified where appropriate. Work is being concentrated on the development of a single long term economic generation expansion plan for the region. The modeling of major transmission and transmission losses has begun and will be included in the overall analysis.

4.6 PROPOSED ACTIVITIES FOR 1985

The activities proposed for 1985 are a continuation of the present work:

1. Continue the development of a long term economic regional generation expansion plan taking into consideration major transmission requirements.

2. Produce a regional load forecast.

3. Produce the load resource balance for generation existing and under construction.

4. Write a formal report(s) on the subcommittee annual activites.

TABLE 1
MARITIME ELECTRIC UTILITIES
LOAD FORECAST

Fiscal Year	System Net Gwh*	Peak Hourly MW
1984-85	17215	3084
85-86	17942	3219
86-87	18712	3360
87-88	19385	3495
88-89	20075	3627
89-90	20675	3741
90-91	21192	3839
91-92	21757	3943
92-93	22316	4046
93-94	22871	4148
94-95	23447	4254
95-96	24109	4375
96-97	24707	4485
97-98	25317	4597
98-99	25944	4710
99-2000	26579	4827

Total Period Averge Annual Growth Rate:

Gwh = 2.9%

MW = 3.0%

* Includes System Losses

TABLE 2

MARITIME ELECTRIC UTILITIES

COINCIDENT PEAK LOAD FORECAST (MW)

FISCAL YEAR	N.B.	N.S.	P.E.I.	TOTAL	REGIONAL DIVERSITY	REGIONAL LOAD
1984-85	1832	1227	106	3165	81	3084
85-86	1894	1297	111	3302	83	3219
86-87	1968	1364	114	3446	86	3360
87-88	2051	1417	116	3584	89	3495
88-89	2134	1467	118	3719	92	3627
89-90	2201	1514	119	3834	93	3741
90-91	2255	1559	120	3934	95	3839
91-92	2314	1604	121	4039	96	3943
92-93	2372	1649	122	4143	97	4046
93-94	2428	1694	124	4246	98	4148
94-95	2484	1745	125	4354	100	4254
95-96	2553	1797	126	4476	101	4375
96-97	2608	1851	127	4586	101	4485
97-98	2664	1907	129	4700	103	4597
98-99	2720	1964	130	4814	104	4710
99-2000	2777	2023	131	4931	104	4827
Average Annual Compound Growth Rate %	2.8	3.4	1.4			3.0

TABLE 3
MARITIME ELECTRIC UTILITIES
1984 LOAD FORECAST SUMMARY
(GWH)

SECTOR	1981-1982	1982-1983	1983-1984	1999-2000
Domestic	4226	4416	4791	8053
% Growth		4.5	8.5	3.3
Commercial	3977	4042	4195	6854
% Growth		1.6	3.8	3.1
Industrial	5679	4988	5871	9347
% Growth		-12.2	17.7	2.9
Total Sales	13882	13446	14857	24254
% Growth		-3.1	10.5	3.1

- % Growths are Annual

TABLE 4

MARITIME ELECTRIC UTILITIES

MONTHLY COINCIDENT PEAK DEMAND FORECAST (MW)

FISC. YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
1984/1985	2554	2356	2259	2141	2205	2277	2438	2747	3084	3080	2962	2868
1985/1986	2663	2444	2334	2210	2273	2355	2535	2856	3219	3212	3092	2989
1986/1987	2777	2537	2417	2284	2348	2440	2636	2973	3360	3352	3230	3119
1987/1988	2887	2627	2500	2358	2425	2524	2737	3086	3495	3486	3362	3245
1988/1989	2996	2719	2582	2433	2500	2608	2835	3197	3627	3618	3490	3368
1989/1990	3089	2798	2654	2500	2568	2684	2922	3293	3741	3729	3599	3472
1990/1991	3170	2867	2717	2558	2628	2748	2997	3377	3839	3827	3695	3564
1991/1992	3257	2942	2787	2623	2693	2820	3076	3468	3943	3929	3795	3660
1992/1993	3343	3019	2856	2689	2761	2891	3158	3556	4046	4030	3895	3754
1993/1994	3427	3093	2926	2754	2828	2963	3236	3645	4148	4130	3992	3849
1994/1995	3516	3173	3000	2822	2898	3039	3320	3738	4254	4235	4094	3947
1995/1996	3618	3261	3084	2902	2978	3124	3416	3842	4375	4353	4210	4058
1996/1997	3709	3341	3161	2974	3052	3202	3501	3939	4485	4460	4315	4158
1997/1998	3803	3427	3239	3047	3126	3282	3589	4036	4597	4571	4424	4262
1998/1999	3897	3512	3318	3123	3204	3364	3679	4136	4710	4681	4533	4367
1999/2000	3995	3598	3399	3201	3283	3446	3771	4238	4827	4794	4644	4474

TABLE 5

MARITIME ELECTRIC UTILITIES

MONTHLY ENERGY FORECAST (GWH)

FISC. YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR
1984/1985	1421	1299	1252	1197	1241	1233	1370	1492	1694	1764	1587	1665
1985/1986	1485	1351	1298	1240	1284	1280	1428	1556	1772	1845	1661	1742
1986/1987	1553	1405	1347	1287	1332	1330	1489	1624	1854	1931	1738	1822
1987/1988	1612	1454	1390	1326	1373	1375	1542	1683	1926	2006	1806	1892
1988/1989	1671	1503	1436	1369	1416	1421	1597	1743	1999	2082	1874	1964
1989/1990	1724	1547	1475	1406	1455	1462	1644	1796	2061	2146	1934	2025
1990/1991	1769	1584	1510	1440	1488	1496	1686	1842	2115	2201	1983	2078
1991/1992	1817	1627	1550	1477	1526	1536	1730	1890	2173	2260	2038	2133
1992/1993	1866	1667	1588	1513	1564	1575	1776	1939	2229	2319	2091	2189
1993/1994	1913	1709	1626	1551	1602	1613	1820	1987	2285	2376	2144	2245
1994/1995	1962	1752	1666	1589	1642	1655	1866	2038	2343	2435	2198	2301
1995/1996	2019	1800	1713	1635	1688	1702	1919	2094	2408	2504	2261	2366
1996/1997	2069	1846	1756	1675	1729	1744	1966	2147	2469	2565	2316	2425
1997/1998	2121	1891	1798	1716	1771	1788	2016	2200	2530	2627	2374	2485
1998/1999	2175	1939	1843	1760	1815	1833	2065	2254	2591	2691	2433	2545
1999/2000	2229	1986	1887	1803	1860	1877	2117	2310	2655	2756	2492	2607

TABLE 6

GENERATING STATION CAPABILITIES - NET MEGAWATTS[1] (MW)
EXISTING AND UNDER CONSTRUCTION
IN NEW BRUNSWICK

Hydro			Thermal			
Mactaquac	1	110	Grand Lake			
	2	110		5	5	
	3	110		6	5	
	4	116		7	15	
	5	113		8	57	
	6	113				
Beechwood	1	36	Chatham	1	9	
	2	36		2	20	
	3	41				
			Courtenay Bay	1	45	
Tobique	1	10		2	12	
	2	10		3	99	
				4	99	
Grand Falls	1	15				
	2	15	Dalhousie	1	102	
	3	15		2	183	2
	4	15				
			Coleson Cove	1	335	4
Milltown		4		2	310	3
				3	335	4
Sisson		9				
			Lepreau Nuclear	1	635	5
Musquash		5				
			Moncton	1	22	
			Grand Manan		3	
Total Hydro		883 MW	Total Thermal		2291 MW	

1 Net megawatt values are derived by subtracting station service requirements from Gross Megawatt Capability.

2 Dalhousie unit 2 capability is reduced by 20 MW to recognize the joint ownership arrangement with Maritime Electric of Prince Edward Island.

3 Coleson Cove Unit 2 available at 184 MW until November, 1985 and 310 MW thereafter because of participation sales.

4 Coleson Cove units 1 and 3 available at 198 MW each until November, 1985 and 335 MW thereafter because of participation sales.

5 Lepreau Nuclear available at 405 MW until Nov. 1, 1991 because of participation sales.

TABLE 7

GENERATING STATION CAPABILITIES - NET MW
EXISTING AND UNDER CONSTRUCTION
IN NOVA SCOTIA

HYDRO	MW	THERMAL	MW
Avon	7	Glace Bay	32
Bear River	36[2]	Lingan 1	150
Black River	21	Lingan 2	150
Dickie Brook	2	Lingan 3	150[1]
Lequille	22	Lingan 4	150[1]
Mersey	44	Point Tupper 1	67
Roseway	1	Point Tupper 2	147
St. Margarets	10	Trenton L.P.	25
Sheet Harbour	10	Trenton 5	140
Tusket	3	Tufts Cove 1	85
Harmony	1	Tufts Cove 2	97
Wreck Cove	223	Tufts Cove 3	149
	———	Maccan	13
		Combustion Turbines	205
TOTAL HYDRO [3]	377	TOTAL THERMAL	1560

1 Under construction, due Commercial in 1984.

2 The 20 MW tidal unit owned by the Tidal Power Corporation has been netted from the system load.

TABLE 8

GENERATING STATION CAPABILITIES - NET MW IN PRINCE EDWARD ISLAND

THERMAL	MW
Charlottetown	19.0
	19.0
	9.5
	7.2
	7.2
	3.8
	1.4
Borden	22.0
	12.8
Summerside	10.1
Dalhousie 2 (NBEPC Purchase)	20.0
TOTAL	132.0

TABLE 9

MARITIME ELECTRIC UTILITIES

LOAD & RESOURCE REVIEW

PEAK ELECTRICAL CAPABILITY CRITERION

FOR THE MINIMUM SURPLUS MONTH

FISCAL YEAR APR/MAR	FORECAST LOAD MW	REQ'D RESERVE MW	REQ'D CAPACITY MW	FOSSIL CAP MW	HYDRO CAP MW	NUCLEAR CAP MW	NUCLEAR PARTICIPATION MW	AVAILABLE NUCLEAR CAP MW	TOTAL RESOURCE MW	SURPLUS MW
1984/1985	3084	614	3698	2944	1264	635	230	405	4613	915
1985/1986	3219	641	3860	3344	1264	635	230	405	5013	1153
1986/1987	3360	670	4030	3344	1264	635	230	405	5013	983
1987/1988	3495	697	4192	3344	1264	635	230	405	5013	821
1988/1989	3627	723	4350	3335	1264	635	230	405	5004	654
1989/1990	3741	746	4487	3322	1264	635	230	405	4991	504
1990/1991	3839	765	4604	3322	1264	635	230	405	4991	387
1991/1992	3943	786	4729	3322	1264	635	0	635	5221	492
1992/1993	4046	807	4853	3322	1264	635	0	635	5221	368
1993/1994	4148	827	4975	3322	1264	635	0	635	5221	246
1994/1995	4254	848	5102	3322	1264	635	0	635	5221	119
1995/1996	4375	873	5248	3322	1264	635	0	635	5221	-27
1996/1997	4485	895	5380	3302	1264	635	0	635	5201	-179
1997/1998	4597	917	5514	3302	1264	635	0	635	5201	-313
1998/1999	4710	940	5650	3277	1264	635	0	635	5176	-474
1999/2000	4827	963	5790	3277	1264	635	0	635	5176	-614

TABLE 10

MARITIME ELECTRIC UTILITIES

LOAD & RESOURCE REVIEW

SUSTAINED ELECTRICAL CAPABILITY CRITERION

FOR THE MINIMUM SURPLUS MONTH

FISCAL YEAR APR/MAR	FORECAST LOAD MW	REQ'D RESERVE MW	REQ'D CAPACITY MW	FOSSIL CAP MW	HYDRO CAP MW	NUCLEAR CAP MW	NUCLEAR PARTICIPATION MW	AVERAGE NUCLEAR CAP MW	TOTAL RESOURCE MW	SURPLUS MW
1984/1985	3080	405	3485	2944	838	635	230	405	4187	702
1985/1986	3212	405	3617	3344	854	635	230	405	4603	986
1986/1987	3352	405	3757	3344	871	635	230	405	4620	863
1987/1988	3486	405	3891	3344	892	635	230	405	4641	750
1988/1989	3618	405	4023	3335	912	635	230	405	4652	629
1989/1990	3729	405	4134	3322	927	635	230	405	4654	520
1990/1991	3827	405	4232	3322	942	635	230	405	4669	437
1991/1992	3929	635	4564	3322	955	635	0	635	4912	348
1992/1993	4030	635	4665	3322	968	635	0	635	4925	260
1993/1994	4130	635	4765	3322	981	635	0	635	4938	173
1994/1995	4235	635	4870	3322	996	635	0	635	4953	83
1995/1996	4353	635	4988	3322	1011	635	0	635	4968	-20
1996/1997	4460	635	5095	3302	1025	635	0	635	4962	-133
1997/1998	4571	635	5206	3302	1040	635	0	635	4977	-229
1998/1999	4681	635	5316	3277	1053	635	0	635	4965	-351
1999/2000	4794	635	5429	3277	1066	635	0	635	4978	-451

FIGURE 1

MARITIME ELECTRIC UTILITIES
LOAD & RESOURCE REVIEW
PEAK ELECTRICAL CAPABILITY CRITERION
FOR THE MINIMUM SURPLUS MONTH

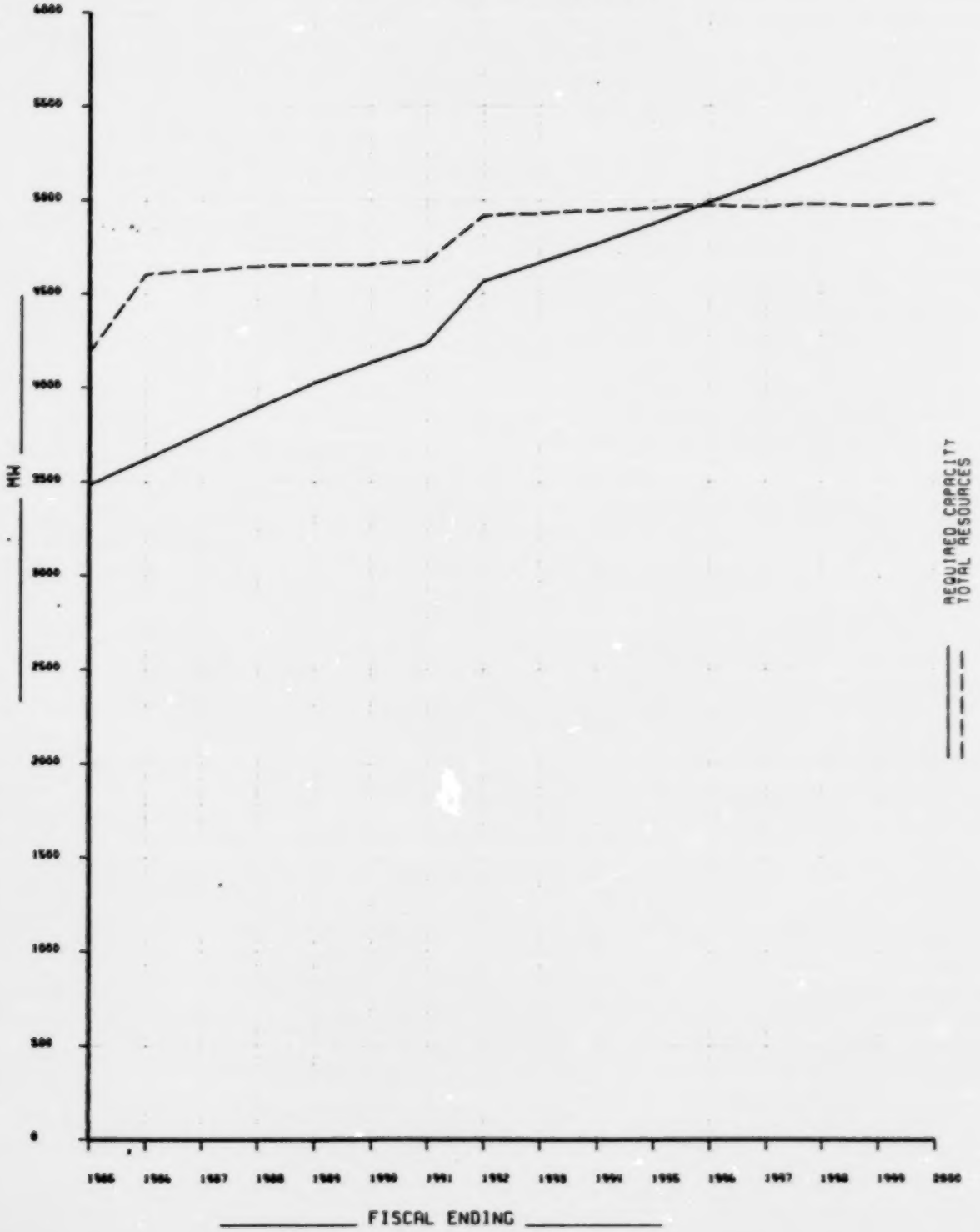
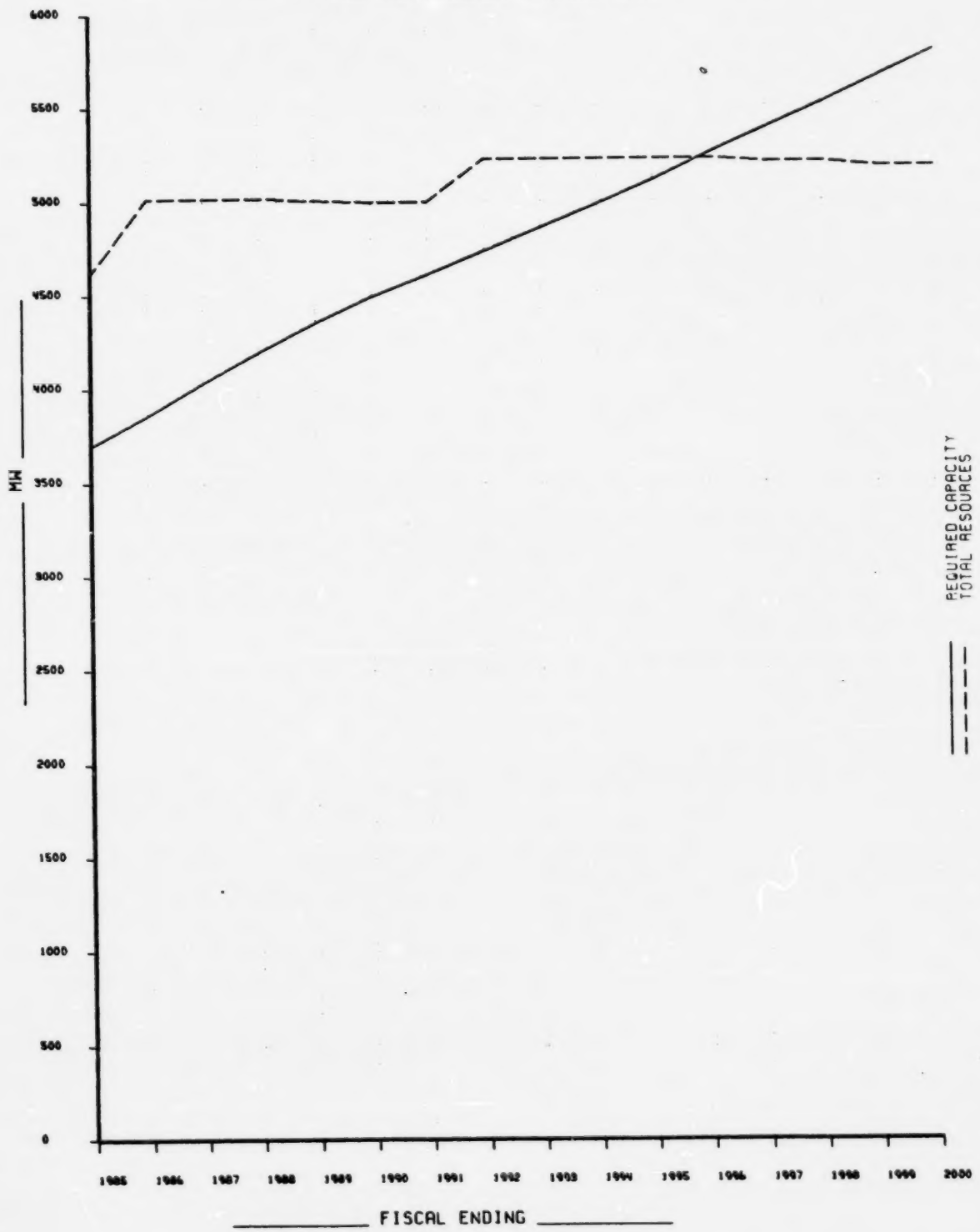


FIGURE 2

MARITIME ELECTRIC UTILITIES
LOAD & RESOURCE REVIEW
SUSTAINED ELECTRICAL CAPABILITY CRITERION
FOR THE MINIMUM SURPLUS MONTH



ANNUAL REPORT

OF THE

RESEARCH AND DEVELOPMENT SUBCOMMITTEE

OF THE

COORDINATING COMMITTEE OF MARITIME ELECTRIC UTILITIES

JANUARY 1985

Members:

J. A. Lea - Chairman, MECL

J. Kiuru, NSPC

P. J. Whalen, NB Power

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5.1. EXECUTIVE SUMMARY

This fourth annual report of the Research and Development Subcommittee of the Co-ordinating Committee of Maritime Electric Utilities (CCMEU) covers the Subcommittee's activities during 1984.

The Subcommittee is pleased to report a continual development in the R&D communications structure in all member utilities.

During 1984 the Subcommittee continued to carry out its mandate as set forth in its Terms of Reference (Section 5.3). A summary of the Subcommittee's achievements for 1984 is shown in Section 5 of this report.

The reports on the status of R&D projects in the Maritime Electric Utilities (Section 5.7) are under continual review with updates scheduled on a semi-annual basis. Recommendations for pooling of resources and results are made whenever such activity will benefit the region.

5.2. INTRODUCTION

This is the fourth annual report of the Research and Development Subcommittee of the CCMEU which was formed in March 1982.

The summary of 1984 activities and the proposed activities for 1984 indicate a continuing increase and improvement in co-operative activity in which the benefits of R&D in the Maritime Electric Utilities are being shared among member utilities.

The contents of this report reflect the continued commitment by CCMEU and its member utilities to promote a regional approach to R&D within the Maritime Provinces.

5.3. TERMS OF REFERENCE

The Regional R&D Subcommittee shall consist of at least one member from each of the province-wide utilities in the Maritime region. The Subcommittee will meet at least twice yearly and will report to the Coordinating Committee of the Maritime Electric Utilities (CCMEU) at least twice yearly.

The Regional R&D Subcommittee shall undertake the following:

5.3.1 Report on all electric utility-related R&D activities that are currently underway in the Maritime provinces.

5.3.2 Set up procedures whereby it is informed of any individual utility initiatives in R&D activity and attempt to achieve regional interest and participation in these activities.

5.3.3 Promote and implement the free exchange of R&D project information, procedures and results in order to share the results of all R&D projects undertaken by each utility. Recommend joint projects when such co-operation would benefit the region.

5.3.4 Review current and planned R&D expenditures by the member utilities and to recommend how maximum regional benefit can be obtained from these expenditures; this would include, but not be limited to the recommending against duplication of R&D effort.

5.3. TERMS OF REFERENCE (cont'd)

5.3.5 Review the current and proposed R&D participation by member utilities in the CEA R&D program, and recommend actions which will enhance the regional benefit of these projects. This includes the possibility of joint proposals and joint bids on R&D contracts by member utilities.

5.3.6 Review R&D activity undertaken by utilities in Canada that is outside the umbrella of the Canadian Electrical Association and obtain the results of that activity for regional use.

5.3.7 Recommend to the CCMEU those R&D initiatives that the Subcommittee thinks should be taken within the region.

5.3.8 For projects which are identified by all member utilities to be of regional interest, but which cannot be funded by CEA or other R&D Funding, the Subcommittee shall request funding by the member utilities through the CCMEU.

5.3.9 Submit minutes of Subcommittee meetings to the Secretary of CCMEU for distribution to members of the CCMEU and its other Subcommittees.

5.3.10 Submit a proposed work program and an expected budget requirement annually to the CCMEU as directed.

5.4 WORK PLAN FOR 1984

5.4.1 Joint Bids and Proposals

Develop procedures for joint proposals and joint bids for R&D projects by several member utilities. This will require careful screening of project requests in order to determine potential regional benefits as well as joint participation capabilities. It is planned that project #3, identified in 5.4.2, be prepared using this format.

5.4.2 Develop Joint R&D Projects

Continue the investigation of, and if all members agree on need, develop proposals and budget estimates for possible regional R&D programs on items such as:

1. Pooling of Load Research and Load Management procedures and data.
2. Review of existing R&D projects now proposed or under way in the region to determine the possibility of pooling of resources and data.
3. Study of Benefits and Cost of Coal Benification in Maritime region.

5.4.3 Pooling of Results of Regional R&D Projects

Develop procedures for suitable pooling of data and results of projects of regional interest, including:

- Marine Corrosion Studies.
- Load Management Studies
- Other areas as identified.

5.4.4 Update of Utility R&D Activity

Continue to update reports of R&D activity in the member utilities, and provide a forum for discussion of projects being carried out in the region.

5.5 SUMMARY OF ACHIEVEMENTS - 1984

5.5.1 Regional Representation on CFB Management Board

Through the initiative of the R&D Subcommittee of the CCMEU, the circulating fluidized bed (CFB) Management Board now has regional representation. Board membership currently consists of N.B. Power, the Government of New Brunswick, Energy, Mines & Resources Canada and N.S. Power. The CFB Management Board provides technical guidance to the work and planning of the Chatham, N.B. CFB project as well as Point Tupper and the N.S. Power 150 MW CFB feasibility study.

5.5.2 Disposal and Utilization of Ash from CFB Boilers

A proposal for research on the disposal and utilization of ash from CFB boilers was developed by the R&D Subcommittee under technical guidance from N.B. Power and N.S. Power, and submitted to the Canadian Electrical Association for consideration. The CEA has approved the funding level of $150,000 for this project.

5.5.3 Regional Coordination of Load Research

During its review of R&D work being carried out by each utility, the Subcommittee identified load research as an activity that had potential for benefit from regional coordination. The Subcommittee has recommended to the CCMEU the formation of a Task Force having a representative

from each utility with the mandate to explore in detail the possible benefits from the sharing of load research data.

5.5.4 Benefits of Coal Cleaning

The R&D Subcommittee's efforts relative to the benefits of coal cleaning has resulted in the submission of a joint proposal on this subject to EM&R.

5.5.5 Update of Regional R&D Activity Report

The Subcommittee continued to update its survey of R&D activities within the region in accordance with its terms of reference. The latest results are contained in Section 7 of this report.

5.6 PROPOSED ACTIVITIES FOR 1985

5.6.1 To continue to investigate areas where joint participation in R&D projects is possible.

5.6.2 To continue to share results of individual R&D projects.

5.6.3 To continue to follow developments in coal benefication studies through the activities of the Committee on Atlantic Coal. The Subcommittee will continue to follow the work of this group in order to ensure that maximum regional benefits and involvement, particularly in the area of economics, are realized from the ongoing work.

5.6.4 To continue to interface with the Circulating Fluidized Bed Management Board in order to identify and promote relevant research which will involve and benefit the region.

5.6.5 To continue to update its survey of R&D activities being carried out by member utilities in accordance with its Terms of Reference.

5.6.6 To carry out a review of the funding level of R&D projects undertaken or initiated by the CCMEU and CEA within the region.

5.6.7 To carry out a review of utility-related R&D funding throughout Canada.

5.7 STATUS OF CURRENT AND COMPLETED R&D ACTIVITIES IN THE MARITIME ELECTRIC UTILITIES

5.7.1 New Brunswick Electric Power Commission R&D Projects

5.7.1.1 Sulphur Oxides Removal from Stack Gas

Objective - To investigate the feasibility of catalytic flue gas desulphurization techniques using various suitable elements.

Description - A catalytic flue gas desulphurization technique was evaluated based on the following reactions.

$$SO_2 + 1/2\ O_2 \xrightarrow{V_2O_5} SO_3 \qquad (1)$$

$$SO_3 + MO \longrightarrow MSO_4 \qquad (2)$$

Where M, represents various suitable elements, i.e.: calcium, magnesium, iron, aluminum, etc.

Project was conducted in co-operation with the University of New Brunswick Department of Chemical Engineering. Tests were performed on flue gas from Grand Lake #8 Unit, indicating that commercial vanadium phenoxide catalyst is effective in promoting conversion of SO_2 to SO_3 (reaction #1 above) under dirty flue gas conditions. Solid reactants including lime and fly ash were not effective in capturing the SO_2 formed

within the reaction time available. Further work is necessary to investigate catalyst life under dusty flue gas conditions and the effect of the physical structure of the CaO and/or MgO on the sulfation reaction (reaction #2).

Status - Completed June 1982.

Cost - $ 66,000

Funding - 100% CEA (Project #G212)

Contact - Phil Whalen (NBEPC)

5.7.1.2 Conversion of an Existing Unit to Fluidized Bed Combustion

Objective - To prepare a conceptual design and cost estimate for the conversion of Chatham #2 Unit to fluidized bed combustion.

Description - This project involved the preparation of a conceptual design and a detailed engineering cost estimate for boiler conversion to fluidized bed combustion. Conversion was identified as technically feasible with completion at an estimated cost of just over $12 million. Electrical output of the converted unit would be 14 megawatts. Annual operating cost in 1979 dollars were estimated at $2.7 million including labour, materials and fueling costs.

Status - Complete

Cost - $65,000

Funding - 100% CEA (Project #G105)

Contact - Dave Rankin (NBEPC)

5.7.1.3 Determination of the Energy Required to Produce Domestic Hot Water

Objective - 1) To determine the range of energy consumptions for representative samples of electric, oil, natural gas and propane water heaters.

- 2) To determine the interrelated effects of hot water consumption, storage temperature, flue gas losses and other parameters on the energy consumption and performance.

- 3) To determine and compare the effectiveness of energy utilization of water heaters using different energy sources.

- 4) To determine the range of user costs for domestic hot water.

Status - Complete May 1981.

Cost - $60,200

Funding - 100% CEA

Contact - Reg Gulliver (NBEPC)

5.7.1.4 Grand Lake Generating Station Aquaculture Project

Objective - To test the biological, technical and economic feasibility of intensive salmonoid aquaculture using warm water from the generating station.

Description - In co-operation with CEA, N.B. Department of Natural Resources and N.B. Coal, a pilot facility has been established at the Grand Lake plant to investigate the feasibility of using plant cooling water output for aquaculture projects.

Status - Completed May 1981, further work undertaken.

Cost - $391,000

Funding - Shared by above agencies

Contact - John Mercer (NBEPC)

5.7.1.5 Utilization of Thermal Station Cooling Water for Hatchery Aquaculture

Objective - To determine the full potential for use of warm water in salmon and trout culture during incubation, hatching and early rearing stages.

Description - This project was established at Grand Lake plant as an extention of Project CEA #909U133, to more fully determine potentials for hatchery aquaculture. This project demonstrates the economic and biological feasibility of utilizing condenser cooling water for year round fish culture activities.

Status - Complete March 1984; results very promising.

Cost - $133,000

Funding - Jointly funded under CEA Project #006U192 by CEA, N.B. Power, and the Department of Natural Resources, N.B. Coal, N.B. Energy Secretariat, E.M.R Canada, N.B. Wildlife Federation and Fisheries and Oceans Canada.

Contact - John Mercer (NBEPC)

5.7.1.6 Development of a Residential Energy Audit Procedure

Objective - To develop energy audit procedures appropriate for low rise residential housing.

Description - This project includes both a review of existing programs being carried out in Canada and parts of the United States as well as a description of the steps to be undertaken to implement a residential audit program throughout the Province of New Brunswick.

Status - Complete

Cost - $45,000

Funding - 100% CEA

Contact - Reg Gulliver (NBEPC)

5.7.1.7 Large Flow Measurements by Dye Dispersion Techniques

Objective - Investigate the possibility of correlating dye dilution concentrations with flow measurements in large water flows.

Description - This technique of flow measurement has been demonstrated on a laboratory research scale and will be calibrated on the large flow system at Alden Research Labs in the United States as part of an Ontario Hydro R&D contract with CEA. This project has been postponed indefinitely due to problems at the U.S. lab. NB Power had conducted some work in this area at Point Lepreau with generally encouraging results. The method shows the promise of high accuracy although great care is required in the laboratory techniques due to the temperature sensitivity of the dye.

Status - Complete.

Cost - $20,000 estimated

Funding - NB Power

Contact - W. Davies (NBEPC)

5.7.1.8 Condenser Fouling Monitor

Objective - To assess the feasibility of on-line indication of tube fouling (CW side).

Description - This project involves the installation of a monitor on Coleson Cove #1 Condenser for the assessment of the on-line indication of tube fouling. By exposing a CW tube to the correct flow rate of cooling water and required heat load the measured delta T can be correlated with the degree of fouling

on the tube. A study is currently underway at Pt. Lepreau to further assess the concept.

Status - Work at Coleson Cove is now complete and a similar project at Pt. Lepreau is underway.

Cost - $60,000

Funding - CEA/N.B. Power

Contact - R. Pickles (NBEPC)

5.7.1.9 Chatham Coal/Water Mixture Demonstration

Objective - To determine the practicality of burning coal/water mixtures as a direct replacement for heavy fuel oil.

Description - This is a joint project of the federal department of Energy Mines and Resources, Cape Breton Development Corporation and N.B. Power. CBDC is responsible for the preparation of the low ash, low sulphur slurry and N.B. Power has burned approximately 5,000 tonnes of CWM fuel in its Chatham #1 and #2 Units. The fuel contains approximately 70% coal, 29% water, and 1% additives with no oil content.

Results to date have proven that CWM of the correct specification can be burned successfully without the need for support fuel. Problems which require further work include improving the consistency of CWM prepared by CBDC as well as further improvement in the burners and fuel handling system at Chatham.

Status - 99% Complete. Final report to be submitted to EMR in January, 1985.

Cost - $7,150,000

Funding - 100% Energy, Mines and Resources Canada

Contact - D. Rankin (NBEPC)

5.7.1.10 Waste Heat Utilization - Surface Heated Greenhouse

Objective - To evaluate a unique application of power station cooling water to reduce heating costs of conventional greenhouses.

Description - This heating concept involves the distribution of a thin layer of water over the roof surface thereby creating a reduced temperature gradient between the inside and apparent outside temperatures. The water layer can be up to 75°F warmer than ambient air temperatures during winter months.

Results of a 1 year study showed that approximately 30% energy savings were realized in the surface heated greenhouse with no deleterious effects.

Status - 99% Complete. Draft final report has been submitted to CEA for review.

Cost - $950,000

Funding - CEA, Energy, Mines & Resources Canada, N.B. Coal and N.B. Power

Contact - J. Mercer (NBEPC)

5.7.1.11 Fish Culture Facility Utilizing Waste Heat from the Mactaquac Generating Station

Objective - To develop a large scale Atlantic salmon hatching and early rearing facility using waste heat from a hydro electric generation station.

Description - Following a pilot scale demonstration in 1982, N.B. Power and the Federal Department of Fisheries are co-operating to develop a large scale Atlantic salmon hatching and early rearing facility at the N.B. Power Mactaquac generating station. The source of waste heat to be used is stator and bearing cooling water which is available from all units at an average of 60 to 70°F. The total flow of available warm water is estimated to be some 6,600 gallons per minute with all units operating. The facility includes an incubation building, a pipeline and distribution system for up to 6 enclosed ponds.

Status - Phase I complete (350,000 salmon) - Demonstration phase. Phase II expansion to 2,000,000 salmon to follow evaluation of demonstration phase.

Cost - $1,000,000

Funding - N.B. Power and Fisheries and Oceans Canada

Contact - J. Mercer (NBEPC)

5.7.1.12 Circulating Fluidized Bed Demonstration Project

Objective - To demonstrate this technology on a utility system utilizing locally available fossil fuels. Following an initial trial period on Maritime fuels the facility will be made available to other Canadian and international interests.

Description - This project includes the construction of a new circulating fluidized bed at N.B. Power's Chatham generating station which will be integrated with the existing 22 MW unit 2 turbine/generator. Following construction the unit will be used to demonstrate the co-combustion of New Brunswick high sulfur coal and low grade oil shales with locally available limestone. The technology promises at least 90% sulfur capture during the combustion process thus enabling compliance with the federal government new source performance guidelines.

Status - A preliminary design study was completed in June, 1984 and detailed design is now underway. Construction is scheduled to commence in the spring of 1985 with the unit ready for commissioning in the fall of 1986. The initial test program is scheduled to run until March 31, 1988.

Cost - $33,000,000

Funding - Energy Mines and Resources Canada

Contact - P. Whalen (NBEPC) or W. Warfe (EMR)

5.7.1.13 Distributed Mixing Coal Burner Development

Objective - To demonstrate this technology on a 1 MMBTU/hr test rig with New Brunswick and Nova Scotia coals, limestone and oil shales.

Description - Distributed mixing combustion of solid fuels has been developed in the U.S. and elsewhere as a means of retrofitting existing coal fired boilers to reduce emissions of nitrogen oxides by as much as 50%. The present project will evaluate this aspect of the technique with local fuels and additionally assess the effect of concurrent injection of sulfur absorbing constituents such as limestone for partial SO_2 emission reduction.

Status - Design of the 1 MMBTU/hr test rig and auxiliaries is essentially complete with construction scheduled to be completed by the spring of 1985.

Cost - $600,000

Funding - Energy, Mines & Resources Canada

Contact - P. Whalen (NBEPC) or W. Warfe (EMR)

5.7.2 NOVA SCOTIA POWER CORPORATION R&D PROJECTS

5.7.2.1 Accelerated Material Evaluation of Polymer Insulators for Transmission Lines (CEA R&D Project No. 121T226)

Objective - To evaluate the effect of pollution on polymer insulators in a salt fog environment.

Description - NSPC is participating in this CEA R&D Project undertaken by IREQ (Hydro-Quebec). Six polymer insulators of three makes, Ohio Brass Hi-Lite, Ceraver Armourlite and Rosenthal Roderflex were installed hot by NSPC on L7011 in the Lingan area in November 1982. One unit of each make was equipped with a corona ring.

Status - Inspected June 1984. Removal date has been deferred from June 1984 to May 1985 to provide more useful information.

Final report is expected before end of 1985.

Funding - $229,230 (CEA R&D Project No. 121-T-226)

5.7.2.2 Annapolis Tidal Project

The pilot project of building a tidal power plant at Annapolis was undertaken by the Tidal Power Corporation (TPC). TPC engaged NSPC to design, construct and operate the tidal power plant. The project employs the larger Stra-flo turbine ever built, a type that is being considered for any future installations in the Bay of Fundy. Annapolis is a demon-

stration project to gather data that could be used in the design of future tidal or lowhead river installations. It will be remote-controlled from one of the NSPC power control centre at Milton. The output at rated head is 17.8 MWe and the runner diameter is 7.6 m.

Status - It was committed for construction early in 1980 and passed its commercial acceptance tests on August 11, 1984. At the time of writing (Nov. 1984) the unit has been operating on every tide without encountering any major difficulties.

Cost - $46 million (estimated)

Funding - Federal Government (EM&R) $25 million

Contact - B. V. McDonald (NSPC)

5.7.2.3 Atmospheric Fluidized Bed Studies

Objective - To build an atmospheric fluidized bed combustor and to conduct a 10,000/hr. test program which is intended to investigate the corrosion/-errossion characteristics of in-bed and convection-pass tube materials.

Description - NSPC is managing the project which includes the design, construction, commissioning and operation of the test rig with a bed size of 1 m. x 1 m. All in-bed and convection pass tubes are water-cooled, air-cooled or uncooled. The rig generates no steam. Combustion Engineering Canada Limited was involved in

the construction of the rig proper, while NSPC is responsible for the balance of the project. Expected completion of the 10,000-hour test program is early in 1986.

Status - Construction and commissioning was completed in 1983 and the test program was about 50% complete as of September 1984.

Cost - Final cost is projected to be slightly less than $8 million for all aspects of the program.

Funding - Energy, Mines and Resources Canada

Contact - N. W. Andrews(NSPC)

5.7.2.4 Circulating Fluidized Bed (CFB) Feasibility Study

Objective - To study the feasibility of circulating fluid bed boilers for Utility application in the 150 MW_e size range. Specifically, instrumentation and control systems will be investigated to prove safe start-up, load following, and flexibility capabilities of the system. Additionally, studies on feedstock preparation and injection, dust collection, and waste disposal will be conducted.

Description - NSPC is managing the study, under the general guidance of the CFB Management Board. An assessment of the capabilities of various manufacturers to build CFB's sized at 150 MW_e will be examined. The Pt. Tupper Generating Station will be used in developing technological scheduling and costing details.

Cost - $500,000 has been appropriated for salaries and expenses associated with the study.

Funding - Financial support will be provided through the offices of the Oil Substitution Committee.

Contact - G. D. Lethbridge (NSPC)

5.7.2.5 Coal-Liquid Mixtures

Through its membership in the Coal-Liquid Mixtures (CLM) Working Group, NSPC is keeping up-to-date on current research and development activity in this emerging technology.

Contact - Jack Kiuru (NSPC)

5.7.2.6 Control of Distribution Line Galloping

(CEA Project No. 196 D 367)

Objective - To obtain reliable observations of performance of promising control devices during galloping occurrences.

Description - Two galloping-control devices, the air-flow spoiler and the detuning pendulum have been installed on a six-span section of line in the Cheticamp area. Eighteen air-flow spoilers were installed, three per span, and six detuning pendulums, one per span, were installed on another phase. The remaining phase will be used as a reference phase.

These tests will determine the overall effectiveness of the control devices under natural galloping conditions.

an additional control device, the interphase spacer, will be installed on four other spans along the same section of line.

The results will provide recommendations on the application of these devices to eliminate or reduce the effects of galloping on existing and new distribution lines.

Status - Commenced in 1984.

Funding - Material and Monitoring Equipment provided by CEA. Control devices installed by NSPC (to be monitored by NSPC).

Contact - K. S. Mathur (NSPC).

5.7.2.7 Development of a One-Ton Line Service Truck Body

In 1983, the Atlantic Utilities reached consensus on a standard one-ton line service body, including basic modular, overall length, width, height, compartment size and layout and options.

General construction drawings and specifications were completed in 1984.

The Atlantic Utility Managers requested that a further report be prepared on availability, cost and economics of aluminum and fiberglass bodies versus steel.

Funding - In-house co-operative project by the Atlantic Utilities.

Contact - J. F. Baird (NSPC)

5.7.2.8 Feasibility Evaluation of Large-Scale Heat Pumps

Objective - Caneur Limited and the N.S. Department of Development are evaluating the application of large-scale (4-10 MW) heat pumps in the Canadian environment. Currently, six potential applications are being detailed so that the feasibility of this equipment can be evaluated for typical applications. This general profiling of potential sites is being completed by the Thermal Production Engineering Department. Participation is expected to yield some knowledge of the technology and possible applications within our system as either a heat source or an energy user.

Contact - I. D. Covill (NSPC)

5.7.2.9 Field Testing of Distribution Equipment and Line Materials in a Marine Atmosphere

Objective - To evaluate corrosion of equipment in a marine atmosphere.

Description - A 25 kV line along Inverness Beach feeding summer cottages has been fitted with various components such as cutouts, lightning arrestors, epoxy arm, insulators, connectors, clamps, etc., to study the effect of salt contamination under normal operating conditions.

This experience will assist in the evaluation and selection of suitable materials for construction of distribution lines in sea coast areas.

Thirty-three powder-coated distribution transformers have been purchased with a polyester finish. They are being installed in salt and industrial-polluted areas in Eastern and Western Zones. Three additional powder coated transformers will be installed as part of CEA R&D Project 78-94.

Status - Commenced 1983 (On going)

Funding - NSPC in-house project

Contact - K. S. Mathur (NSPC)

5.7.2.10 Marginal Cost-Based Peak Load Pricing and Load Control Study

Objective - To ascertain whether certain pricing and load control systems can, in fact, lead to more efficient utilization of NSPC's capital and energy resources at a net benefit to its customers and Corporations;

- To investigate the theoretical background and applicability of marginal cost pricing concepts; and;

- To develop, in the process, modeling techniques for load and sales forecasting, as well as system and financial planning.

Description - The study deals with many subsidiary issues which are critical to the achievement of the objectives. Among these will be the cost effectiveness of metering and load control systems, sample

selection techniques, corporate operating procedures, administrative feasibility of alternative rate designs and software system design.

Status - The project was started in April 1979 with initial studies relating to cost of service, cost allocation, marginal cost, and load and sales forecasting, conducted with the help of consultants.

Equipment installation is essentially complete and computerized collection of metering data from over 800 sites throughout the province covering all classes of service. Information on kW and VAR demand for every 15 minutes will be recorded. The data is collected using the telephone system to call each collector approximately every 5 days. The Maritime Telegraph and Telephone Company is co-operating with NSPC in this experiment.

A time-of-use experiment for a sample of industrial and commercial customers is planned for 1985 subject to regulatory approval. In addition, a load management experiment involving 50 domestic water heaters will go into operation early in 1985.

Cost - $3,225,000 for equipment and external consulting.

- NSPC manhours not included in cost.

Funding - Total of $3,225,000 funded 80% by Federal government and 20% by Province of Nova Scotia.

Additional funding of $215,000 for continuation of the project will be made available from the Canada Oil Substitution Agreement.

Contact - Jack Kiuru (NSPC)

5.7.2.11 Osprey Nesting on Transmission Lines

Objective - To extend previous research in osprey nest relocation.

Description - Criteria for the relocation of osprey nests have been tested during one field season at six sites in Nova Scotia. The relocation structures have been 100% successful in attracting osprey away from transmission pole structures. The second field season will be used to verify these preliminary results and to study osprey population dynamics.

Status - Commenced October 1983, Interim Report due 1984, continuing.

Cost - $71,085

Funding -	N.S. Power Corporation	$ 11,353
	N.S. Department of Lands & Forests	24,332
	St. Francis Xavier University	16,910
	CEA	18,490

Contact - T.P. Toner, Environmental Specialist (NSPC)

5.7.2.12 Performance of Preservative-Treated White and Red Spruce Poles

Examination for Checking Toughness (CEA R&S Project 77-29A)

Approximately 144 ACA-treated spruce poles have been installed in the Guysborough Area (Dickie Brook line). These poles were cut from Hants County, Nova Scotia, in 1977-78.

Incisions were made along the full length of the poles and full-cell treatment of ACA treatment was applied in accordance with CSA Standard O-80. The penetration depth averaged to 1.10 inches.

A common complaint from the linemen was the hardness of the poles and vertical splits making them difficult to climb.

Examination of the poles carried out in 1981 showed incised poles as moderately checking and non-incised poles as severely checking.

Hardware removed from some poles in 1984 showed signs of corrosion.

Status - Commenced in 1980 (poles inspected in 1981 and 1984).

Funding - Poles and installation funded by NSPC. Inspection and report funded by CEA R&D.

Contact - K. S. Mathur (NSPC).

5.7.2.13 Wind Generation Experiment

A wind turbine was placed in service at South Lake, near the Wreck Cove Hydro Development in 1981. The intent was to generate energy equivalent to that required to pump additional water into the Wreck Cove head pond. Initial problems characterized by wide power swings were corrected by replacing the synchronous generator with an induction generator. Further problems with the micro-processor control unit and with cracks in one of the blade spars delayed the final commissioning of the unit. The manufacturer has supplied diagonal braces for installation between the blades. These have been installed and the unit is now generating on a part-time basis. Further modifications may be required to the cracked spar if additional deterioration takes place. Modifications to the micro-processor are being planned to reduce the number of shut downs that are occurring.

Contact - L. R. Feetham (NSPC)

5.7.3 MARITIME ELECTRIC COMPANY, LIMITED R&D PROJECTS

5.7.3.1 Wind Test Site - North Cape, P.E.I.

Description - This is a national facility available to Government and private industry for field testing of windmills. Laboratory facilities provide data acquisition for the determination of unit performance.

Status - In operation

Funding - Site is operated by Resource Ventures Ltd. under long term contract from the P.E.I. government with an annual operating grant from N.R.C.

MECL Involvement - MECL has agreed to purchase output on an "energy displacement" basis. MECL also provides technical assistance on an 'as required' basis.

Contact - J. A. Lea (MECL)

5.7.3.2 Coal Liquid Mixture Combustion - Charlottetown, P.E.I.

Objective - To determine the practicality of burning coal/water mixtures as a direct replacement for heavy fuel oil.

Description - This project is designed to investigate the practicality and effectiveness of burning a Carbogel (coal/liquid) mixture in a utility boiler originally designed to burn oil. As well, the project will demonstrate the feasibility of production and delivery of Carbogel in sufficient quantities for combustion.

Further information to be gained from the project includes:

- transportation, storage and handling of Carbogel
- modification to oil fired boilers
- combustion efficiency
- economic data

Status - Submission to Treasury Board awaiting approval. Project scheduled for completion March 1986.

Cost - $8.8 million

Funding - Energy, Mines & Resources Canada, Maritime Electric Company, Limited, Cape Breton Development Corp.

Contact - C. W. Lynds (MECL)

5.7.3.3 Wood Burning, Charlottetown Plant

Objective - To determine the technical and economic feasibility of burning wood as a fuel for electrical generation.

Description - This project is designed to review earlier work done on the feasibility of burning wood in existing or new boilers at Charlottetown Plant. It is proposed to re-examine earlier work done in the area, in view of present costs for wood fuel and new boiler designs.

Cost - $ 50,000.

Funding - Maritime Electric Company, Limited

Status - To be carried out in 1985.

Contact - J. A. Lea

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